

## ABSTRACT OF THE DISCLOSURE

Methods and apparatus for varying and measuring the position of a micromachined electrostatic actuator using a pulse width modulated (PWM) pulse train are disclosed. One or more voltage pulses are applied to the actuator. In each of the pulses, a voltage changes from a first state to a second state and remains in the second state for a time  $t_{\text{pulse}}$  before returning to the first state. The position of the actuator may be varied by varying the time  $\Delta t_{\text{pulse}}$ . A position of the actuator may be determined by measuring a capacitance of the actuator when the voltage changes state, whether the time  $t$  is varied or not. An apparatus for varying the position of a MEMS device may include a pulse width modulation generator coupled to the MEMS device an integrator coupled to the MEMS device and an analog-to-digital converter coupled to the integrator. The integrator may measure a charge transferred during a transition of a pulse from the pulse generator. The integrator may include an amplifier, an integrator capacitor, a hold capacitor, a compensation voltage generator and three switches. The hold capacitor and integrator capacitor may be coupled to a MEMS device. The integrator capacitor, hold capacitor, and compensation voltage generator may be selectively coupled to the amplifier by two of the switches. The MEMS device and hold capacitor may be selectively coupled to ground by a third switch.